

VeDBA computation

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1 Vectorial Dynamic Body Acceleration

VeDBA is a radial metric, which is ideally the same no matter how an accelerometer is placed on the body of an animal. Plotted on a logarithmic x-axis, a histogram of VeDBA can show multiple, very distinct peaks. These can be used to infer activity levels of an animal without delving deep into machine-learning frameworks. Importantly, unless accelerometers have been very precisely calibrated, it does not make sense to compare actual VeDBA values across individuals. Instead, one can choose to define activity levels for each individual (using aforementioned histograms), and then compute metrics like time-spent-in-high-activity-state, which will generalize well across individuals.

2 Computing VeDBA

Choose a time window. Let us say it is 2 seconds for now. Then, chunk all available accelerometer data into 2 second windows. For each of these windows, define

$$X = [x, y, z],$$

where x, y and z are each vectors containing many accelerometer readings. Note that each of these vectors is 2~s long.

At this point, find $\text{mean}(x)$, $\text{mean}(y)$, and $\text{mean}(z)$. Let us call them \bar{x}, \bar{y} , and \bar{z} . These numbers represent the so-called static component of acceleration. For simplicity, imagine it this way: these numbers together represent the gravity vector at that time, depending on the animal's posture. We will get rid of this static component by subtracting them from the accelerometer readings. Let $\tilde{x}_i = x_i - \bar{x}$. Do likewise for y and z , obtaining \tilde{y}_i and \tilde{z}_i . Together,

$$\tilde{X} = [\tilde{x}, \tilde{y}, \tilde{z}]$$

is called the ‘dynamic component’ of acceleration, and represents acceleration due to the animal's own behaviour. Once you have these dynamic acceleration vectors, for each window, perform the following sum:

$$\text{VeDBA} = \sum_{i=0}^N \sqrt{(\tilde{x}_i^2 + \tilde{y}_i^2 + \tilde{z}_i^2)},$$

if N is the number of points in each 2 second window.

Doing this for each 2 second window, you will be able to compute VeDBA for those time-points.